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Pressure leaching of copper concentrates at Morenci, Arizona – 10 years of experience

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Abstract

In 2003, a high-temperature pressure leaching circuit to treat copper sulfide concentrates was commissioned at the copper/molybdenum operation at Bagdad, AZ. In late 2007, a medium-temperature pressure leaching circuit was commissioned at the Morenci mine in Arizona. The Morenci circuit was shut down in mid-2008, following a fire in the autoclave circuit. The onset of the global financial crisis in late 2008 resulted in significant changes to the operating profile in the Southwestern United States with respect to concentrates production, concentrates treatment, acid production and acid consumption. As a result of these changes, the Morenci concentrator was shut down, and the pressure leaching circuit remained offline. In late 2014, the increasing acid requirements in the Southwestern United States prompted a reevaluation of the Morenci concentrate leaching facilities. As a result, the pressure leaching circuit was restarted in high-temperature (200 °C) mode in May 2015 and has operated successfully for three years since recommissioning. This paper describes the current pressure leaching circuit configuration and the factors leading to the successful application of copper sulfide concentrate leaching at this location.

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Key words: Copper, Pressure leaching, Copper sulfide concentrates

Introduction and background

Freeport-McMoRan has been working on the development and implementation of effective hydrometallurgical processes to treat copper sulfide concentrates since 1998. These efforts resulted in a number of process developments, culminating in the successful commissioning of a high-temperature pressure leaching demonstration plant at Bagdad, AZ, in early 2003 (Marsden, 2007). The plant was designed to treat approximately 56 kt/a of chalcopyrite-dominant copper sulfide flotation concentrates produced at the Bagdad site, equivalent to about 15 percent of annual production at the mine. The pressure leaching step was designed to operate at 225 °C and 3,300 kPa. The facility ramped up to full capacity within three

months and achieved copper extractions of greater than 98.5 percent into solution. The average annual production rate was 15,875 t of copper. The high-grade pregnant leach solution (PLS) was blended with a large volume of low-grade stockpile leaching solution. Copper was recovered through the existing solvent extraction (SX) circuit, with minor modifications, and subsequently by electrowinning (EW) in an expanded tankhouse at the site. An acid cost credit was provided to the concentrate pressure leaching operation for the acid delivered to the low-grade stockpile leaching solution. The oxygen requirement for the pressure leaching step was approximately 0.87 t/t concentrate. Oxygen utilization was greater than 85 percent. The operating costs for the overall process were competitive compared to smelting and refining when considering the acid cost credit. The Bagdad circuit and high-temperature

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